TREK COMMAND TUTORIAL

November 2012

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1. Introduction

This tutorial describes commanding in the Telescience Resource Kit (TReK) and how it works with different command interfaces. There are two interface documents that describe the interfaces TReK must meet in order to send commands. The first is the POIC to Generic User Interface Definition Document Volume 2, a.k.a. the PGUIDD (SSP-50305). The PGUIDD defines everything about interfacing with any Enhanced Huntsville Operation Support Center (HOSC) System (EHS). This includes the Payload Operations Integration Center (POIC), the Kennedy Space Center (KSC) Payload Test and Checkout System (PTCS), or any other facility that uses EHS.

The second interface document is for the Suitcase Simulator system. The Suitcase Simulator To TReK Interface Control Document (ICD-3-60079) defines the simple commanding interface between TReK and a Suitcase Simulator.

These two documents define what TReK can and cannot do when sending commands. You can read them if you would like to understand TReK's interface to these systems, but this tutorial should contain all of the information you need in order to use TReK commanding capabilities. The sections that follow will help you become familiar with the terms and concepts that are used with commanding in TReK.

For further information on commanding in the POIC see the following documents:

- MSFC-STD-2535: MSFC HOSC Command Format Standard
- HOSC-EHS-065: The EHS Concepts and Scenarios Document
- MSFC-DOC-1949: MSFC HOSC Database Definitions
- SSP-50304: POIC Capabilities Document
- SSP-50305: POIC To Generic User IDD

2. Command Basics

Many terms and concepts related to commanding are shared between TReK and the POIC. This section will cover those items as well as some terms and concepts unique to TReK. Some of the terminology is slightly different for TReK. This section will also correlate terminology for TReK to similar terms in the POIC.

2.1 Commands and Headers

Two terms used extensively in all of TReK commanding are commands and headers. The command is the actual user data that gets to your experiment. It contains the binary code that tells the payload what to do. The headers are placed in front of the commands to help the computer systems get the command to the correct payload as shown in Figure 1.

Figure 1 Command with Header

The term command is also frequently used to mean both the command data portion and the header.

2.1.1 CCSDS and EXPRESS Headers

For International Space Station (ISS) EXPRESS rack users there are actually two sets of headers on the command. The first is the CCSDS header. It consists of both a primary and secondary header. Whenever you see the term header in the POIC documentation, this is the header being referenced. The CCSDS header consists of 20 bytes as shown in Figure 2.

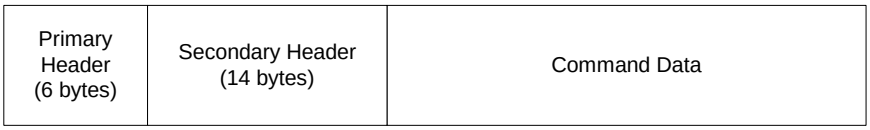

Figure 2 Command with CCSDS Headers

The EXPRESS header follows the CCSDS headers and consists of 8 bytes as shown in Figure 3.

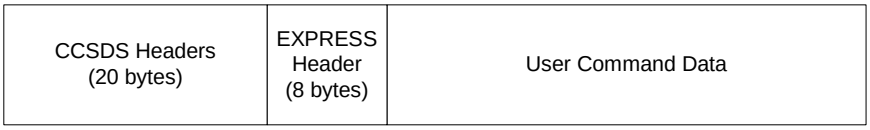

Figure 3 Command with CCSDS and EXPRESS Headers

2.1.2 Differences Between TReK and the POIC

One of the differences between TReK commanding and commanding in the POIC is the relationship between headers and commands. Both systems use the same concept that a header is placed in front of a command. However, the header defined within the POIC is just the CCSDS portion of the headers. The EXPRESS header is actually considered part of the command data. If you use the POIC Partial Command Database Download capability to build a TReK command database from the POIC Operational Command Database (OCDB) in the POIC, TReK will consider the EXPRESS header as part of the command data also.

If you decide to define your commands and headers in the TReK database without performing a partial database download, you can choose to define the EXPRESS header as part of the header for the command. This difference is only on the TReK side. The

POIC will always have the header being only the CCSDS primary and secondary headers. Defining the EXPRESS header as part of the overall header structure may allow you to define the EXPRESS header only once for the database instead of once for each command. As a matter of fact, you can even define part of your command data as a header if you want to.

2.2 Fields

Command fields and header fields are the individual values that make up a command or header. For the most part there are no differences between TReK and the POIC in how they handle fields. In many ways fields can be considered the command equivalent of telemetry parameters. Each field has a value, either supplied by the user or calculated by the TReK or POIC software. More details about fields will be discussed later.

2.3 Databases

TReK has its own database for commanding. This database can be built from the partial database download capability from the POIC or generated by a TReK user with the TReK Command Database application. The command database in the POIC, the Operational Command Database (OCDB), contains the definition of commands for use by the POIC. The POIC can use this database to build your command for you.

You can also build the command from definitions in the TReK database or just use an empty database if you don't need TReK to build the command for you.

2.4 Destinations

Destinations in TReK are the computer systems where TReK sends the command. At this time there are two types of destinations: POIC and Suitcase Simulator.

2.4.1 POIC Destination

The POIC destination is used whenever you need to send a command to a destination, such as the POIC, that is an EHS. This includes the PTCS at KSC. The POIC destination requires you to log on through the EHS Remote Interface System (ERIS), which is described later. Once connected you will be able to uplink commands, update commands, process command responses, and receive status describing the current state of the command system you have connected to.

The connection to the POIC is via TCP, so each command you send will not be lost somewhere along the way on the network. The POIC destination also sends back different responses informing you on the status of your request. For example, if you update a command in the POIC database you will get back a response to let you know if the update worked.

2.4.2 Suitcase Simulator Destination

Unlike the POIC destination, the Suitcase Simulator destination does not require a login. When using a Suitcase Simulator destination, you will only be able to send commands to the remote system. The Suitcase Simulator does not have or use a local database. Therefore you cannot send update requests to the remote system.

The interface between TReK and the Suitcase Simulator is via UDP, so it is possible for a command to not make it or to arrive out of order. However, this is very unlikely to occur unless great distances separate the systems and the rate of sending commands is very high. The Suitcase Simulator, unlike the POIC, does not send any command responses back to confirm that it received the command. Therefore, you will have to use a Suitcase Simulator application to verify that commands arrived or verify changes in telemetry via the TReK Application Programming Interface (API).

2.5 Security

Commanding requires a high level of security when communicating with the POIC. However, there is no security in place when communicating with the Suitcase Simulator. The sections below briefly describe the security that is used when commanding with the POIC.

2.5.1 VPN

Virtual Private Networks (VPN) are used widely in securing network communication. For communication with the POIC, you will be required to establish a VPN connection before requesting any services. This requires you to use the VPN client (VPN-1/SecuRemote) to make a secure link between your computer and the POIC. Once you have established this connection all network traffic between the two computers will be encrypted.

2.5.2 ERIS

Once a VPN connection is established you can use the Command Processing application to establish a command session. Part of establishing the command session, is identifying the information needed to login to the EHS Remote Interface System (ERIS). The details of how you enter this information is found in the Command Processing User's Guide (TREK-USER-023). What follows is a high level definition of the information that is passed between the TReK system and ERIS.

ERIS will first prompt you with a dialog that informs you that you are logging into a U.S. Government computer. The username and password is then sent to ERIS. If the login is allowed you will have to choose which MOP to use. MOP is an acronym for Mission, Operational Support Mode, and Project. You will use a different MOP for flight than for testing. If there is only a single MOP to choose from, you will automatically be placed in that MOP. At this point, you can request the commanding services be started by the

POIC. You will enter most of the information when configuring the destination. This means that the activation will not require you to do anything more than say ok to the warning message and maybe select the MOP.

Note: Tests with the POIC have shown that the amount of time from the selection of the MOP until the POIC is ready for requests can take over a minute. You can watch Command Processing's message area for information on the login process.

3. Sending a Command and Tracking It

3.1 Different Ways To Build Your Command

The POIC provides two means of uplinking a command, the POIC builds it or you build it. TReK provides three different ways for building your own commands. All four of the options for sending commands are available with a POIC destination. However, the option for the POIC to build the command is not available for a Suitcase Simulator destination.

3.1.1 POIC Builds It

The POIC can build a command from the contents contained in the POIC OCDB. TReK provides a command user API function that you can use in your own applications or you can use the Command Processing application. The contents of the command built can be changed by updating the command fields as described in Section 4. (Note: the POIC does not provide an interface to update header fields for a command.)

This option is available only for POIC destination types.

3.1.2 You Build Everything

For this option, you can supply the entire uplink pattern, including all headers, to TReK via the command user API. TReK wraps the supplied uplink pattern with any headers needed for the communications between TReK and the destination. The bit pattern you send is what is uplinked. (Note: actually this isn't entirely true for POIC destinations. TReK must reset the time in the CCSDS header to be within +/- 1 minute of the POIC time. This requirement is part of the interface definition. Since the time is reset, the checksum is also recalculated. You could provide the uplink pattern without the time being set if you wish.)

This option is available for all destinations. The above note only applies to the POIC destinations.

3.1.3 TReK Builds Everything

For this option, you must have the command and header defined in the TReK command database associated with a destination. The command and header information can be entered directly into the Command Database application or can be created from a partial database download from the POIC command database. Once the information is provided in the database, you can request TReK to build the uplink pattern from the contents of the database (actually local memory). TReK will then send the resulting bit pattern to the destination.

You can update the values of command and header fields as described in Section 4. When TReK builds the command, you can have calibrators defined for your fields. See section 3.2 for more information. This interface is available for all destination types.

3.1.4 You Build the Command Data, TReK Builds the Header

This option is a combination of the two previous options. You provide the command data portion of the command and TReK will build the header from the information contained in the database. You can specify the header to use (or if you leave it blank, TReK will use what is defined in the database).

The header field values can be updated as described in Section 4. This option is available for all destination types.

3.2 Calibration

There are three types of calibration that can be performed by TReK for command fields: Polynomial Coefficient, Point Pair, and State Code. Polynomial Coefficient and Point Pair Calibration are the same as telemetry with one exception. If the uplink field is an integer, the calibrated value will be rounded to the nearest integer within the tolerance specified in the database. Otherwise, an error will occur and the command will not be uplinked. If no tolerance is specified in the database, the tolerance is assumed to be zero. You can read section 4.3.1 and 4.3.2 of the TReK Telemetry Tutorial (TREK-USER-002) for more information on Polynomial Coefficient and Point Pair calibration.

State Code Calibration for commanding has the opposite meaning in commanding than telemetry (no reason is known why it carries the same name). For commanding, state code calibration is converting from a state code, or string value, to an unsigned integer. For example, you may want to set a one-bit field to zero if a device is to be turned off and one if the device is to be turned on. You could assign a State Code Calibrator to the field that correlates OFF to 0 and ON to 1. This would allow you to set the field value based on a string, but have an integer uplinked.

3.3 Keeping Up With The Command

When you send a command you will have different levels of insight into how far the command is along the way to your payload. For the POIC you will get messages from the POIC, SSCC, and the spacecraft. On the other end of the spectrum is the Suitcase Simulator destination where you will know when you sent the command, but will have to rely on telemetry values or Suitcase Simulator provided applications to notify you of its receipt by your payload.

You may receive up to six messages when sending commands to the POIC. Table 1 shows each of these messages and provides a brief description. This information is made available through the command track portion of the Command Processing application.

Response	Description
ERR	EHS Reaction Response. This is the first message received when sending a command. This response is from the POIC system and will notify you of any errors processing your command in the POIC. For example, the POIC will send error number 35 if the user is disabled.
CAR1	First Command Acceptance Response. Returned from SSCC via the POIC when POIC is configured to process this message.
CAR2	Second Command Acceptance Response. Returned from SSCC via the POIC when POIC is configured to process this message.
FSV1	First Flight System Verifier. Returned from SSCC via the POIC when POIC is configured to process this message.
FSV2	Second Flight System Verifier. Returned from SSCC via the POIC when POIC is configured to process this message.
CRR	Command Reaction Response. Message indicating if telemetry changes expected from this command occurred. This message will only be sent if telemetry data has been defined in the POIC database for the uplinked command.

Table 1 POIC Command Responses

4. Updating a Field Value

The fields that make up a command or header can be predefined or modifiable. The user cannot change predefined fields. For modifiable fields the user can set the value of the fields to change the contents of the command that is uplinked. The next sections describe what can occur in the local database and the POIC database. Of course, the local database functions apply to all destinations and the POIC database applies only to POIC destinations.

4.1 Updating Local Field Values

The TReK command user API provides three functions to update a command or header field. There is a function for numeric fields, string fields, and binary fields. The method you will use depends on the input data type. TReK recognizes three basic input data types: strings, numbers, and binary. TReK provides range checking for field values based on information provided in the local database.

Each field is updated separately and every field must have a value defined before uplinking a command. In many instances, modifiable fields will already have a default value. However, sometimes a field does not have a default value. In these cases, you must specify a value with the Command User API from one of your applications or through the command update capability in the Command Processing application if you want TReK to build and uplink the command.

4.2 Updating Field Values in the POIC Database

For POIC destinations it is possible for you to update the contents of the command in the POIC database with the contents of the command in you local database. The message that is generated by TReK will include all of the modifiable fields for the command.

It is important to note that while you can update header field values in the local database, there is no interface provided to update the header field values in the POIC database.

5. More on Destinations

Everything with commanding in TReK revolves around destinations. It is the center of the commanding universe. The sections that follow contain more detailed information about destinations and the capabilities provided for them. Many of the items are POIC specific since the capabilities provided by the POIC are greater than those of the Suitcase Simulator.

5.1 Real-Time Viewing

When you add a destination to TReK you can specify if you would like the real-time viewing capability (it is turned on by default). The real-time viewing capability will allow you to see all of the network communication for the destination. The information is printed in both hexadecimal and as readable text. This information can be used for debugging/troubleshooting with the POIC or Suitcase Simulator.

For POIC destinations, you can also have real-time viewing for the ERIS connection. This will include all information passed to and received from ERIS. Please note that the password will appear as a series of '*'.

5.2 Recording and Playback

You can also record all of the information that you can see with real-time viewing. The data is recorded to the disk in files that are similar to telemetry record files. These files can be played back into a viewer at a later time. This will allow you to maintain a record of all of the commanding activity on your system.

5.3 Status and Configuration

Just like everything else, the POIC provides much more detail about its configuration and status than the Suitcase Simulator. The POIC informs you if the user is enabled, if the command system is enabled, and much more. Table 2 contains some of the more important items contained in the configuration and status messages from the POIC.

Item	Explanation
Clear To Send	Indicates when it is ok to send another command uplink request. All of the messages indicated here must be received or an error must occur before sending another command uplink request.
User Enabled	Indicates if the user is enabled for commanding.
Command Enabled	Indicates if the individual command is enabled.
CAR Processing Enabled	If disabled, you will not receive any CAR1 or CAR2 messages.
FSV Processing Enabled	If disabled, you will not receive any FSV1 or FSV2 messages.
CRR Processing Enabled	If disabled, you will not receive a CRR message even if you have everything needed for CRR processing defined in the POIC database.
AOS/LOS	Indicates if MCC-H has AOS or LOS.

Table 2 POIC Status and Configuration

For both destination types you can get indications on the record status and other non-destination specific items.

5.4 Destination Checks (POIC Specific)

You can have TReK perform uplink checks for POIC destinations. These destination checks are based on the status and configuration of several items described above. These checks will prevent a request from being sent if the POIC is going to reject it anyway. For example, if you want to uplink a command and the POIC has indicated that the user is disabled, then TReK will not send the request. The destination checks can be very helpful when using non-blocking destinations.

5.5 Blocking and Non-Blocking Destinations (POIC Specific)

For POIC destinations it is possible to have either a blocking or non-blocking interface. Before explaining the differences between these two, it is best to explain a little bit about the interface with the POIC. When a command uplink or update request is sent to the POIC, the sending computer must wait for certain messages to be sent back before sending the next request. For example, when sending an update request to the POIC no other messages should be sent until an update response message is sent from the POIC. Any request that is sent to the POIC before it is ready will be rejected. Therefore, TReK is designed to prevent requests from being sent before the POIC is ready.

If you have a blocking destination, then all requests sent to the POIC via the Command User API will block if there is another request pending. For example, you have two applications that send a command. The first application sends a command to the POIC. When the second application sends the command, it must wait until the first application's request receives all of the necessary responses before sending its command. All of this happens just by choosing a blocking destination. One of the advantages of the blocking destination is that the return code of the Command User API function will contain any errors that may occur while sending the request, including command response errors.

If you have a non-blocking destination, then all requests sent to the POIC via the Command User API are placed in a queue and sent when the POIC is ready for requests. Using the same example as above, the first application sends a command to the POIC as before except that it doesn't wait for responses. The second application will have its command placed in a queue for uplink. This means that the Command User API function will return immediately and not wait for the command to actually be uplinked. Non-blocking destinations will not return any information about the responses from the POIC. However, if you are using the destination checks described in the previous section you can queue up all of the commands you want to send before you are enabled. Once the destination identifies that the user is enabled all of the requests (both uplink and update) are sent.

Appendix A Glossary

Note: This Glossary is global to all TReK documentation. All entries listed may not be referenced within this document.

Application Programming Interface (API)	A set of functions used by an application program to provide access to a system's capabilities.
Application Process Identifier (APID)	An 11-bit field in the CCSDS primary packet header that identifies the source-destination pair for ISS packets. The type bit in the primary header tells you whether the APID is a payload or system source-destination.
Calibration	The transformation of a parameter to a desired physical unit or text state code.
Communications Outage Recorder	System that captures and stores payload science, health and status, and ancillary data during TDRSS zone of exclusion.
Consultative Committee for Space Data Systems (CCSDS) format	Data formatted in accordance with recommendations or standards of the CCSDS.
Consultative Committee for Space Data Systems (CCSDS) packet	A source packet comprised of a 6-octet CCSDS defined primary header followed by an optional secondary header and source data, which together may not exceed 65535 octets.
Conversion	Transformation of downlinked spacecraft data types to ground system platform data types.
Custom Data Packet	A packet containing a subset of parameters that can be selected by the user at the time of request.
Cyclic Display Update Mode	A continuous update of parameters for a particular display.
Decommutation (Decom)	Extraction of a parameter from telemetry.
Discrete Values	Telemetry values that have states (e.g., on or off).

Dump	During periods when communications with the spacecraft are unavailable, data is recorded onboard and played back during the next period when communications resume. This data, as it is being recorded onboard, is encoded with an onboard embedded time and is referred to as dump data.
Enhanced HOSC System (EHS)	Upgraded support capabilities of the HOSC systems to provide multi-functional support for multiple projects. It incorporates all systems required to perform data acquisition and distribution, telemetry processing, command services, database services, mission support services, and system monitor and control services.
Exception Monitoring	A background process capable of continuously monitoring selected parameters for Limit or Expected State violations. Violation notification is provided through a text message.
Expected State Sensing	Process of detecting a text state code generator in an off-nominal state.
EXPRESS	An EXPRESS Rack is a standardized payload rack system that transports, stores and supports experiments aboard the International Space Station. EXPRESS stands for EXpedite the PRocessing of Experiments to the Space Station.
File transfer protocol (ftp)	Protocol to deliver file-structured information from one host to another.
Flight ancillary data	A set of selected core system data and payload health and status data collected by the USOS Payload MDM, used by experimenters to interpret payload experiment results.

Grayed out	Refers to a menu item that has been made insensitive, which is visually shown by making the menu text gray rather than black. Items that are grayed out are not currently available.
Greenwich Mean Time (GMT)	The solar time for the meridian passing through Greenwich, England. It is used as a basis for calculating time throughout most of the world.
Ground ancillary data	A set of selected core system data and payload health and status data collected by the POIC, which is used by experimenters to interpret payload experiment results. Ground Ancillary Data can also contain computed parameters (pseudos).
Ground receipt time	Time of packet origination. The time from the IRIG-B time signal received.
Ground Support Equipment (GSE)	GSE refers to equipment that is brought in by the user (i.e. equipment that is not provided by the POIC).
Ground Support Equipment Packet	A CCSDS Packet that contains data extracted from any of the data processed by the Supporting Facility and the format of the packet is defined in the Supporting Facility's telemetry database.
Huntsville Operations Support Center (HOSC)	A facility located at the Marshall Space Flight Center (MSFC) that provides scientists and engineers the tools necessary for monitoring, commanding, and controlling various elements of space vehicle, payload, and science experiments. Support consists of real-time operations planning and analysis, inter- and intra-center ground operations coordination, facility and data system resource planning and scheduling, data systems monitor and control operations, and data flow coordination.

IMAQ ASCII	A packet type that was added to TReK to support a very specific application related to NASA's Return to Flight activities. It is not applicable to ISS. It is used to interface with an infrared camera that communicates via ASCII data.
Limit Sensing	Process of detecting caution and warning conditions for a parameter with a numerical value.
Line Outage Recorder Playback	A capability provided by White Sands Complex (WSC) to play back tapes generated at WSC during ground system communication outages.
Measurement Stimulus Identifier (MSID)	Equivalent to a parameter.
Monitoring	A parameter value is checked for sensing violations. A message is generated if the value is out of limits or out of an expected state.
Parameter	TReK uses the generic term parameter to mean any piece of data within a packet. Sometimes called a measurement or MSID in POIC terminology.
Payload Data Library (PDL)	An application that provides the interface for the user to specify which capabilities and requirements are needed to command and control his payload.
Payload Data Services Systems (PDSS)	The data distribution system for ISS. Able to route data based upon user to any of a number of destinations.
Payload Health and Status Data	Information originating at a payload that reveals the payload's operational condition, resource usage, and its safety/anomaly conditions that could result in damage to the payload, its environment or the crew.
Payload Operations Integration Center (POIC)	Manages the execution of on-orbit ISS payloads and payload support systems in coordination/unison with distributed International Partner Payload Control Centers, Telescience Support Centers (TSC's) and payload-unique remote facilities.

Payload Rack Checkout Unit (PRCU)	The Payload Rack Checkout Unit is used to verify payload to International Space Station interfaces for U.S. Payloads.
Playback	Data retrieved from some recording medium and transmitted to one or more users.
Pseudo Telemetry (pseudo data)	Values that are created from calculations instead of directly transported telemetry data. This pseudo data can be created from computations or scripts and can be displayed on the local PC.
Remotely Generated Command	A command sent by a remote user whose content is in a raw bit pattern format. The commands differ from predefined or modifiable commands in that the content is not stored in the POIC Project Command Database (PCDB).
Science data	Sensor or computational data generated by payloads for the purpose of conducting scientific experiments.
Subset	A collection of parameters from the total parameter set that is bounded as an integer number of octets but does not constitute the packet itself. A mini-packet.
Super sampled	A parameter is super sampled if it occurs more than once in a packet.
Swap Type	A flag in the Parameter Table of the TReK database that indicates if the specified datatype is byte swapped (B), word swapped (W), byte and word swapped (X), byte reversal (R), word reversal (V) or has no swapping (N).
Switching	A parameter's value can be used to switch between different calibration and sensing sets. There are two types of switching on TReK: range and state code.

Transmission Control Protocol (TCP)	TCP is a connection-oriented protocol that guarantees delivery of data.
Transmission Control Protocol (TCP) Client	A TCP Client initiates the TCP connection to connect to the other party.
Transmission Control Protocol (TCP) Server	A TCP Server waits for (and accepts connections from) the other party.
Telemetry	Transmission of data collected form a source in space to a ground support facility. Telemetry is downlink only.
Telescience Support Center (TSC)	A TSC is a NASA funded facility that provides the capability to plan and operate on-orbit facility class payloads and experiments, other payloads and experiments, and instruments.
User Application	Any end-user developed software program that uses the TReK Application Programming Interface software. Used synonymously with User Product.
User Data Summary Message (UDSM)	Packet type sent by PDSS that contains information on the number of packets sent during a given time frame for a PDSS Payload packet. For details on UDSM packets, see the POIC to Generic User IDD (SSP-50305).
Uplink format	The bit pattern of the command or file uplinked.
User Datagram Protocol (UDP)	UDP is a connection-less oriented protocol that does not guarantee delivery of data. In the TCP/IP protocol suite, the UDP provides the primary mechanism that application programs use to send datagrams to other application programs. In addition to the data sent, each UDP message contains both a destination port number and a fully qualified source and destination addresses making it possible for the UDP software on the destination to deliver the message to the correct recipient process and for the recipient process to send a reply.

User Product	Any end-user developed software program that uses the TReK Application Programming Interface software. Used synonymously with User Application.
Web	Term used to indicate access via HTTP protocol; also referred to as the World Wide Web (WWW).

Appendix B Acronyms

Note: This acronym list is global to all TReK documentation. Some acronyms listed may not be referenced within this document.

AOS	Acquisition of Signal
API	Application Programming Interface
APID	Application Process Identifier
ASCII	American Standard Code for Information Interchange
CAR	Command Acceptance Response
CAR1	First Command Acceptance Response
CAR2	Second Command Acceptance Response
CCSDS	Consultative Committee for Space Data Systems
CDB	Command Database
CDP	Custom Data Packet
COR	Communication Outage Recorder
COTS	Commercial-off-the-shelf
CRR	Command Reaction Response
DSM	Data Storage Manager
EHS	Enhanced Huntsville Operations Support Center (HOSC)
ERIS	EHS Remote Interface System
ERR	EHS Receipt Response
EXPRESS	Expediting the Process of Experiments to the Space Station
ES	Expected State
FAQ	Frequently Asked Question
FDP	Functionally Distributed Processor
FSV	Flight System Verifier
FSV1	First Flight System Verifier
FSV2	Second Flight System Verifier
FPD	Flight Projects Directorate
FTP	File Transfer Protocol
GMT	Greenwich Mean Time
GRT	Ground Receipt Time
GSE	Ground Support Equipment
HOSC	Huntsville Operations Support Center
ICD	Interface Control Document
IMAQ ASCII	Image Acquisition ASCII
IP	Internet Protocol
ISS	International Space Station
LDP	Logical Data Path
LES	Limit/Expected State
LOR	Line Outage Recorder
LOS	Loss of Signal
MCC-H	Mission Control Center – Houston
MOP	Mission, Operational Support Mode, and Project

MSFC	Marshall Space Flight Center
MSID	Measurement Stimulus Identifier
NASA	National Aeronautics and Space Administration
OCDB	Operational Command Database
OS	Operating System
PC	Personal Computer, also Polynomial Coefficient
PCDB	POIC Project Command Database
PDL	Payload Data Library
PDSS	Payload Data Services System
PGUIDD	POIC to Generic User Interface Definition Document
POIC	Payload Operations Integration Center
PP	Point Pair
PRCU	Payload Rack Checkout Unit
PSIV	Payload Software Integration and Verification
RPSM	Retrieval Processing Summary Message
SC	State Code
SCS	Suitcase Simulator
SSP	Space Station Program
SSCC	Space Station Control Center
SSPF	Space Station Processing Facility
TCP	Transmission Control Protocol
TReK	Telescience Resource Kit
TRR	TReK Receipt Response
TSC	Telescience Support Center
UDP	User Datagram Protocol
UDSM	User Data Summary Message
URL	Uniform Resource Locator
USOS	United States On-Orbit Segment
VCDU	Virtual Channel Data Unit
VCR	Video Cassette Recorder
VPN	Virtual Private Network